Title: QUALITY OF SERVICE RESOURCE MANAGEMENT APPARATUS AND METHOD FOR
MIDDLEWARE SERVICES
Inventors: Guijun Wang, et al
Atty. Ref.: 7784-000719
Attorney Elizabeth D. Odell (314) 726-7500

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FIG. 1

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100

```
<!-- Quality of Service Request Message --><!-- Common Shared Attribute Definition -->
<!ENTITY % time-unit ' unit    (millisecond|second|minute|hour|day) "second"'>
...
<!-- Root Element: Quality of Service Message              -->
<!ELEMENT qos-message (profile?, performance?, reliability?, timeliness?, security?)>
 <!-- profile encodes the information regarding the requesting client and the messages -->
<!ELEMENT profile (client?, topic?, content-type*)>
...  116          104                        110
<!ELEMENT performance (response-time?, throughput?, volume-rate?, delay?, pay-load?)>
<!ELEMENT response-time EMPTY>
<!ATTLIST response-time %time-period;>
<!-- response-time is the time spent by a single node (e.g., InfoBroker) -->
<!-- from the time a publication is received to the time it is delivered -->      110
...       104
<!ELEMENT reliability (delivery?, loss-probability?, error-rate?, retry?, persistency?, criticality?) >
<!ELEMENT delivery EMPTY>
<!ATTLIST delivery guaranteed-delivery (yes|no) "no"
                   duplication-elimination (yes|no) "no"
                   message-ordering (no|yes) "no">
<!-- corresponds to the Web Service Reliability attributes -->
...       104                                    110
<!ELEMENT timeliness (time-to-live?, deadline?, priority?) >
<!ELEMENT time-to-live EMPTY>
<!ATTLIST time-to-live %time-period; >
<!-- relative to the time when the message is received -->
......
<!ELEMENT security (signature?, encryption?) >          110
...
                  104
```

Fig. 2

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200

```
<?xml version="1.0"?>
<!DOCTYPE qos-message SYSTEM "QoSMessage.8.dtd">
<qos-message>
 <profile>
  <client name='Pub1' role='publisher'/>
  <topic>Logistics</topic>
  <content-type>text</content-type>
 </profile>
 <performance>
  <volume-rate unit='second'>100</volume-rate>
  <pay-load volume='32' unit='kilobyte'/>
 </performance>          104          110
 <reliability>
  <delivery guaranteed-delivery='yes'/>
  <criticality level='red'/>
 </reliability>
</qos-message>
```
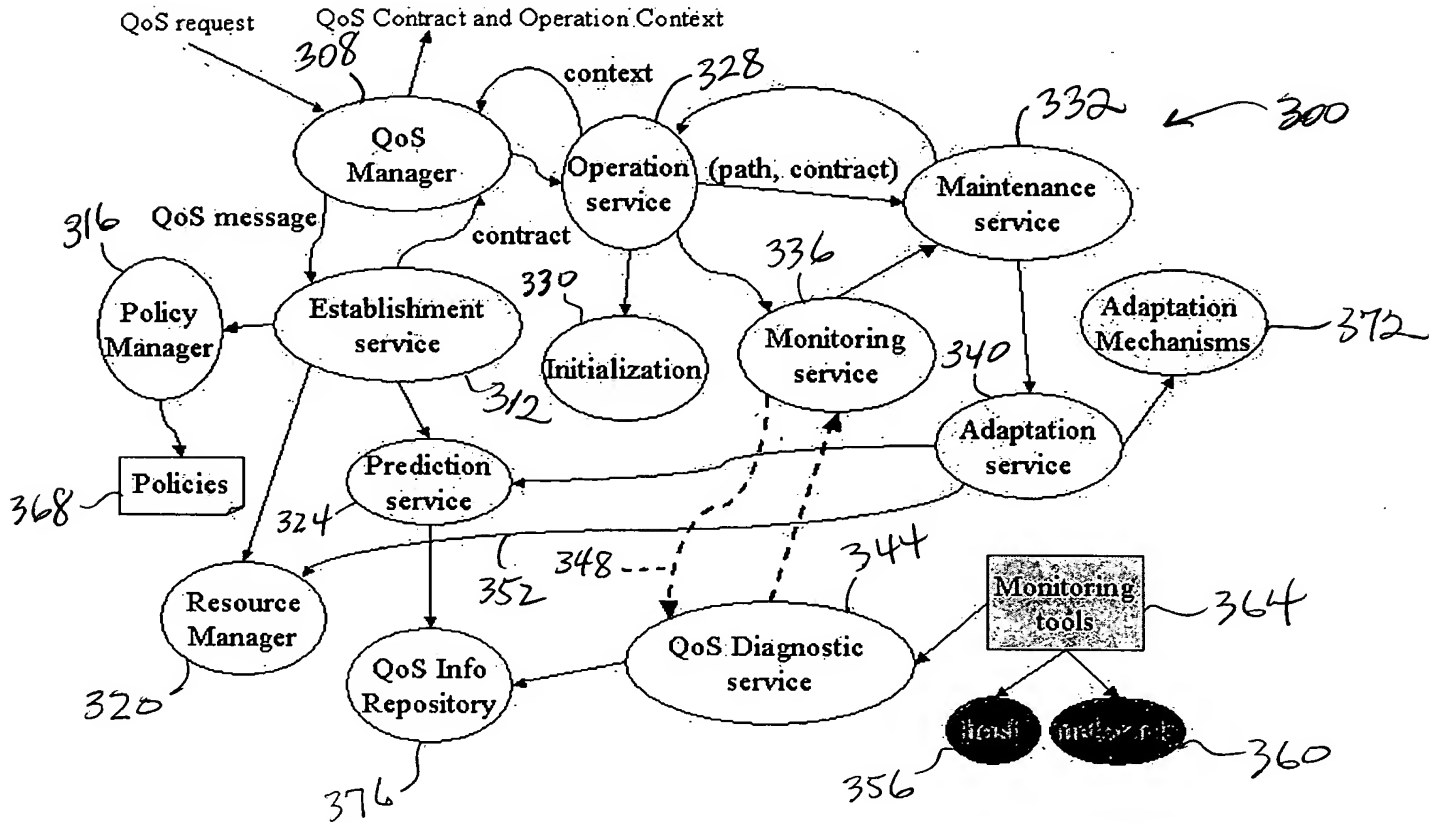
FIG. 3

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FIG. 4

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```
public interface QosManager {
```

408 — QoSContract establishQosContract (String clientID, String qosMessage)
                                    throws QosManagerChannelException;

412 — QoSContract reviseQosContract (String clientID, String qosMessage)
                                    throws QosManagerChannelException;

416 — void agreeQosContractOffer (String clientID, QoSContract contract)
                                    throws QosManagerChannelException;

420 — void abortQosEstablishment (String clientID, QoSContract contract)
                                    throws QosManagerChannelException;

```
}
```

400

FIG. 5

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FIG. 6

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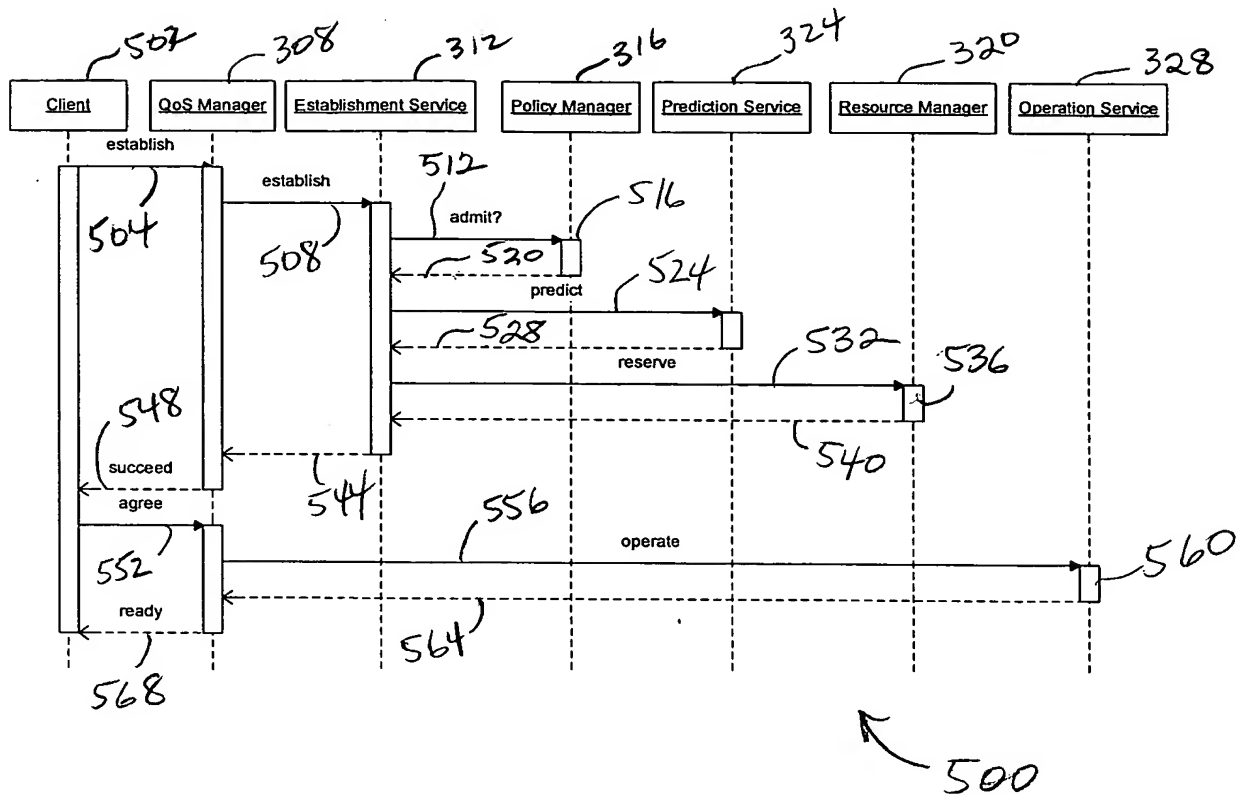Attorney Elizabeth D. Odell (314) 726-7500

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~600

```
public abstract class Resource {
        protected boolean sharable;

604
644    public static Resource create(QoSContract contract, Element config, Class clazz) throws ...;
       public void attach(QoSContract contract) throws ResourceException;
608    public void configure(QoSContract contract, Element config) throws ResourceException;
       public void reconfigure(QoSContract contract, Element config) throws ResourceException;
616    public void cancel(QoSContract contract) throws ResourceException;
612    public void commit(QoSContract contract) throws ResourceException;
628    public void release(QoSContract contract) throws ResourceException;

620    public void activate() throws ResourceException;
624    public void freeze() throws ResourceException;

632    public Prediction predict() throws ResourceException;
636    public void register(QoSContract contract, Monitor monitor) throws ResourceException;
       public void unregister(QoSContract contract, Monitor monitor) throws ResourceException;
640    public void adapt(QoSContract contract, Adaptation adaptation) throws ResourceException;
       }
```

FIG. 7